MThambeliyagodage\_Data605\_W13\_Assign13

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# Data 605 Assignment 13

### Problem 1

Use integration by substitution to solve the integral below.

#### Solution 1

Let , then .

### Problem 2

Biologists are treating a pond contaminated with bacteria. The level of contamination is changing at a rate of bacteria per cubic centimeter per day, where is the number of days since treatment began. Find a function to estimate the level of contamination if the level after day was bacteria per cubic centimeter.

#### Solution 2

$$
\frac{dN}{dt} = N'(t) = \frac{-3150}{t^4}-220 \\
\int{(\frac{-3150}{t^4}-220) dt} = \frac{1050}{t^3}-220t+C = N(t)
$$

Since , then

The level of contamination can be estimated by the following function:

### Problem 3

Find the total area of the red rectangles in the figure below, where the equation of the line is .

#### Solution 3

Each square in the graph has an area of . Each rectangle has a width of . Counting each rectangle left to right the areas are .

A more elegant and more universal solution can be produced using integral.

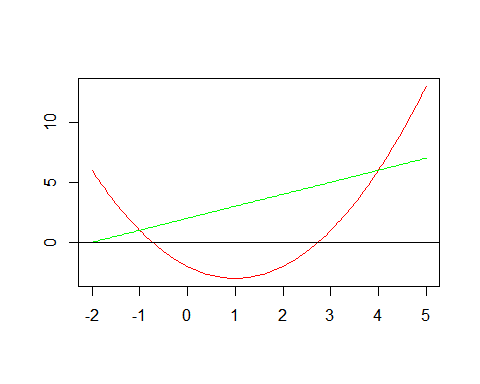
It is important to note that the line cuts off a quarter of a unit square from each rectangle. These little triangles above the line are the same as the missing triangles below the line, so the area of all rectangles is equal to the area under the line from (where the line intersects the axis) to (the right side of the last rectangle).

### Problem 4

Find the area of the region bounded by the graphs of the given equations.

#### Solution 4

Let us plot two functions. is in red and is in green.



Because the quadratic function dips below the axis, we need 4 points to evaluate the integrals and find the area - intersections of two functions and roots of the quadratic function.

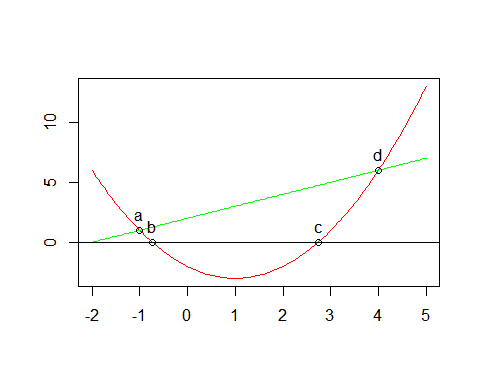
Let us find roots of the quadratic function .

Let us find the intersection of two functions. They intersect where .

Find the roots.

Four points are as follows…

## [1] -1.0000000+0i -0.7320508+0i 2.7320508-0i 4.0000000-0i



The area between two graphs is equal to the area under function 2 from to minus the area under function 1 from to and from to plus the area over function 1 from to .

## [1] 20.83333

### Problem 5

A beauty supply store expects to sell 110 flat irons during the next year. It costs $3.75 to store one flat iron for one year. There is a fixed cost of $8.25 for each order. Find the lot size and the number of orders per year that will minimize inventory costs.

#### Solution 5

Let be a number of flat irons to order.

To find the minimized value, differentiate and solve at :

Each order should contain flat irons, so there should be orders.

### Problem 6

Use integration by parts to solve the integral below.

#### Solution 6

Let , then .

Let , then .

Using the formula for integration by parts:

### Problem 7

Determine whether is a probability density function on the interval . If not, determine the value of the definite integral.

#### Solution 7

The definite integral of the function on interval is . Additionally, if , then , so for this interval . As long as outside of the given interval, this satisfies PDF requirements and this function **is a probability density function**.